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(54) **Wind turbine with deployable air deflectors**

(57) An apparatus and system for compensating for various load situations in a turbine includes the use of one or more deployable devices configured to extend an air deflector outwardly from a surface of a rotor blade. The air deflector may subsequently be retracted into the rotor blade once the load falls below a certain threshold. Mechanisms for extending and retracting the air deflector may include pneumatic, hydraulic and/or electromechanical devices. Air deflectors are generally configured to

modify the air flow around the rotor blade to increase or decrease power generation, or reduce loads so that the risk of potential damage to components of the wind turbine is minimized. Deflectors may be positioned at various chordwise stations including leading-edge, mid-chord, and trailing-edge locations on the upper and lower surfaces at spanwise positions. Accordingly, a plurality of devices can be actuated to aerodynamically control rotor performance and loads based on wind conditions.

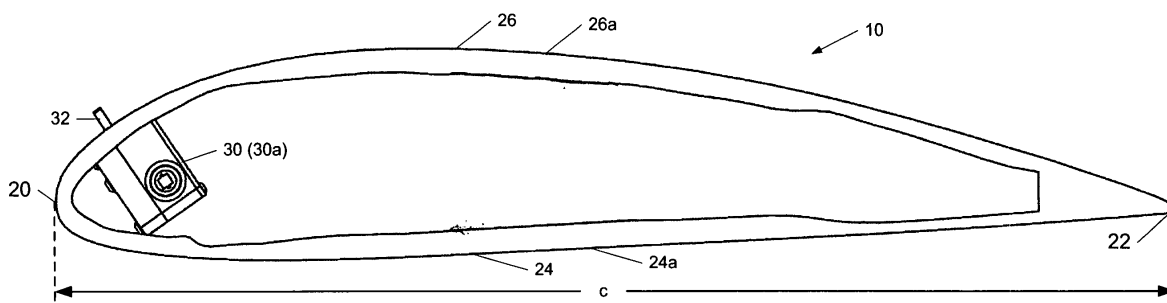


Figure 2



EUROPEAN SEARCH REPORT

Application Number
EP 09 25 1327

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
|--|---|--|---|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
| X | WO 2004/099608 A1 (LM GLASFIBER AS [DK]; PEDERSEN BERNT EBBE [DK]; DAHL VESTERGAARD JOERG) 18 November 2004 (2004-11-18) * abstract * * page 3, line 3 - line 9 * * page 4, line 1 - line 9 * * page 4, line 17 - page 5, line 5 * * page 5, line 14 - line 27 * * page 7, line 11 - line 24 * * page 8, line 7 - page 9, line 19 * * page 10, line 5 - line 6 * * figures 2-5 * | 1-29 | INV. F01D5/14 F01D17/04 F03D7/02 F03D1/06 |
| X | WO 02/29247 A1 (BONUS ENERGY AS [DK]; STIESDAL HENRIK [DK]) 11 April 2002 (2002-04-11) * abstract * * page 5, line 19 - line 25 * * page 6, line 12 - line 24 * * page 7, line 26 - page 8, line 31 * * page 9, line 20 - line 32 * * page 10, line 23 - line 32 * * figures 5,6,9,10 * | 1-29 | TECHNICAL FIELDS SEARCHED (IPC) F03D |
| X | US 2003/218102 A1 (VAN DAM CORNELIS P [US] ET AL) 27 November 2003 (2003-11-27) * paragraph [0006] * * paragraph [0014] * * paragraph [0042] * * paragraph [0048] * * figures 3-6, 9-11,15-17 * | 1-17 | |
| A,D | US 2003/223868 A1 (DAWSON MARK H [US] ET AL) 4 December 2003 (2003-12-04) * abstract * * paragraph [0018] * * paragraph [0051] - paragraph [0053] * * figures 1-9 * | 1-29 | |
| The present search report has been drawn up for all claims | | | |
| Place of search The Hague | | Date of completion of the search 20 March 2012 | Examiner Westermayer, Philipp |
| CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document | | T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document | |

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EUROPEAN SEARCH REPORT

Application Number
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| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
|---|---|---|---|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
| A | GB 2 185 788 A (NEI INTERNATIONAL RESEARCH & D NORTHERN ENG IND [GB]) 29 July 1987 (1987-07-29) * abstract * * page 1, line 119 - page 2, line 12 * * figures 1-3 * | 1-29 | |
| A | WO 2007/045940 A1 (VESTAS WIND SYS AS [DK]; GODSK KRISTIAN BALSCHMIDT [DK]; NIELSEN THOMA) 26 April 2007 (2007-04-26) * abstract * * figures 4,5 * | 1-29 | |
| | | | TECHNICAL FIELDS SEARCHED (IPC) |
| | | | |
| The present search report has been drawn up for all claims | | | |
| Place of search The Hague | | Date of completion of the search 20 March 2012 | Examiner Westermayer, Philipp |
| <p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p> | | | |

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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20-03-2012

| Patent document cited in search report | | Publication date | Patent family member(s) | Publication date |
|---|----|---------------------|----------------------------|---------------------|
| WO 2004099608 | A1 | 18-11-2004 | AT 408754 T | 15-10-2008 |
| | | | DK 1623111 T3 | 12-01-2009 |
| | | | EP 1623111 A1 | 08-02-2006 |
| | | | ES 2314394 T3 | 16-03-2009 |
| | | | PT 1623111 E | 30-01-2009 |
| | | | US 2007003403 A1 | 04-01-2007 |
| | | | WO 2004099608 A1 | 18-11-2004 |
| ----- | | | | |
| WO 0229247 | A1 | 11-04-2002 | AT 293213 T | 15-04-2005 |
| | | | AU 9164101 A | 15-04-2002 |
| | | | DE 60110098 D1 | 19-05-2005 |
| | | | DE 60110098 T2 | 18-05-2006 |
| | | | DK 1320680 T3 | 11-07-2005 |
| | | | DK 200001450 A | 30-03-2002 |
| | | | EP 1320680 A1 | 25-06-2003 |
| | | | ES 2240519 T3 | 16-10-2005 |
| | | | US 2003091436 A1 | 15-05-2003 |
| | | | WO 0229247 A1 | 11-04-2002 |
| ----- | | | | |
| US 2003218102 | A1 | 27-11-2003 | NONE | |
| ----- | | | | |
| US 2003223868 | A1 | 04-12-2003 | AU 2003247489 A1 | 19-12-2003 |
| | | | CA 2494119 A1 | 11-12-2003 |
| | | | EP 1534952 A1 | 01-06-2005 |
| | | | US 2003223868 A1 | 04-12-2003 |
| | | | US 2005285406 A1 | 29-12-2005 |
| | | | WO 03102414 A1 | 11-12-2003 |
| ----- | | | | |
| GB 2185788 | A | 29-07-1987 | NONE | |
| ----- | | | | |
| WO 2007045940 | A1 | 26-04-2007 | CA 2625070 A1 | 26-04-2007 |
| | | | CN 101351640 A | 21-01-2009 |
| | | | EP 1952015 A1 | 06-08-2008 |
| | | | US 2009074574 A1 | 19-03-2009 |
| | | | WO 2007045940 A1 | 26-04-2007 |
| ----- | | | | |